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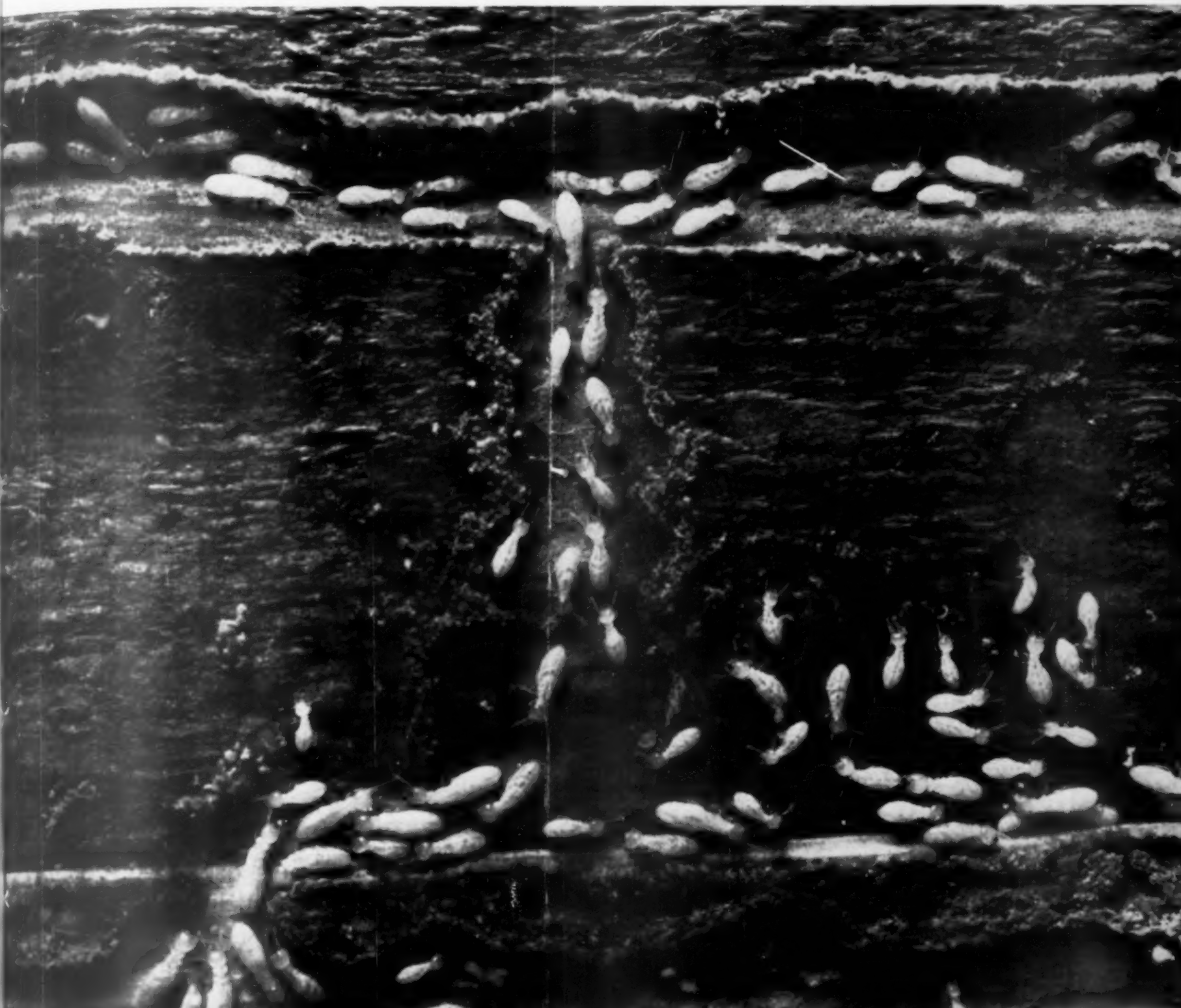

Heredity and Environment

Homefront Conservation

Biology Appreciation

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COVER PHOTOGRAPH

This photograph, which shows subterranean termites in their tunnels, was taken by J. C. Allen and Son, photographers, West Lafayette, Indiana.

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MESSAGE FROM THE NEW PRESIDENT

Dear Members of the National Association of Biology Teachers:

I am most grateful to you for electing me to be your president for the coming year. My duties during the past year, and especially that of organizing the NABT meeting at Berkeley, make me keenly aware of the responsibilities of the office. Consequently, I accept it with both fear and confidence—fear that I may not measure up to the trust placed in me, and confidence because of that spirit of helpfulness which seems to be characteristic of this Association. Possibly, I am much in the same position as an old colored gentleman whose accomplishments were seemingly far beyond his evident capacities. When asked how he was able to do all these things he replied that the Lord, who gave him these jobs, never gave him one which the Lord and himself could not finish. And, I feel certain that NABT will not assign me any tasks which you, NABT members, and myself cannot complete effectively. I need your help and I feel confident that you will give it. Thank you again for this honor.

BROTHER H. CHARLES, F.S.C.
President, National Association of Biology Teachers

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Heredity and Environment

A. M. WINCHESTER, Head
Department of Biology
Stetson University

The author is head of the biology department at Stetson University, DeLand, Florida. He is the author of well-known college texts in the fields of Genetics, Biology, and Zoology. He has just completed a book, *Heredity and Your Life*, which is to be published soon.

Whenever a teacher of biology begins discussions of heredity, it is usually not long before a hand goes up in the class and the question is asked, "Which is more important, heredity or environment?" Or, as the study progresses, perhaps the question comes up, "Is a certain characteristic due to heredity or environment?" Such questions indicate a vital fault in the understanding of the relation of heredity to environment and no teacher should consider the subject of heredity satisfactorily covered until such faulty thinking is corrected. Too often we find the impression in the minds of students that some characteristics are due solely to heredity, others are due solely to environment, and that it is an easy matter to catalogue these and determine which is more important in the total make-up of an individual. As our understanding of the complex process of heredity progresses, however, it becomes more and more evident that practically all characteristics represent a blending of the effects of heredity and environment. While the relative influence of each of the two may vary in specific characteristics, we can hardly find a single human trait which does not reflect a considerable degree of both. This discussion is presented with the hope that teachers may find in it some material which will help them to develop a clearer understanding of this vital topic in the minds of their students.

Let us begin with an example in domestic rabbits—with a characteristic which, after breeding tests, appears to depend largely on the genes of heredity, yet which further study shows to result from an interesting combination of heredity and environment. Rabbits which express the Himalayan coat pattern are white over most of the body, but have black fur on the legs, tail, ears, and nose. Breeding experiments have shown that this coat pattern is inherited as a simple recessive characteristic. A rabbit will show this coat pattern when it receives a specific gene from each parent (when it is homozygous for this gene), in such breeding tests. Certainly, here is a characteristic in which environment seems to play no significant part. Let us see what happens, however, when experiments with temperature variation are performed on rabbits from a pure Himalayan stock.

Suppose we take some naked, new-born rabbits from this stock and place them in an environment where the temperature is less than 52 degrees for a short time. When their skins are thoroughly chilled we return them to a warm environment. As the hair grows out it will be black all over their bodies. Further experiments show the effect of temperature on localized body areas. We can pluck the hair from the back of a mature Himalayan rabbit and place an ice pack in this region. As the hair grows out it will be black on this part of the body. The reverse experiment can also be performed—we can pluck hair from the black region of a leg and apply a bandage on this plucked region. When the hair grows out it will be white because the bandage held the body heat and kept the skin warmer than usual.

Thus, it is evident that something other than genes is operating in the production of the Himalayan coat characteristic. Further experiments show that the areas of the body which have skin temperatures that drop below 92 degrees are black, while the areas which stay above this point are white. This explains the black legs, ears, tail, and nose—these extremities have a lower temperature than the other areas of the body. To attempt to explain this, one theory has been formulated which holds that there is an enzyme for black pig-

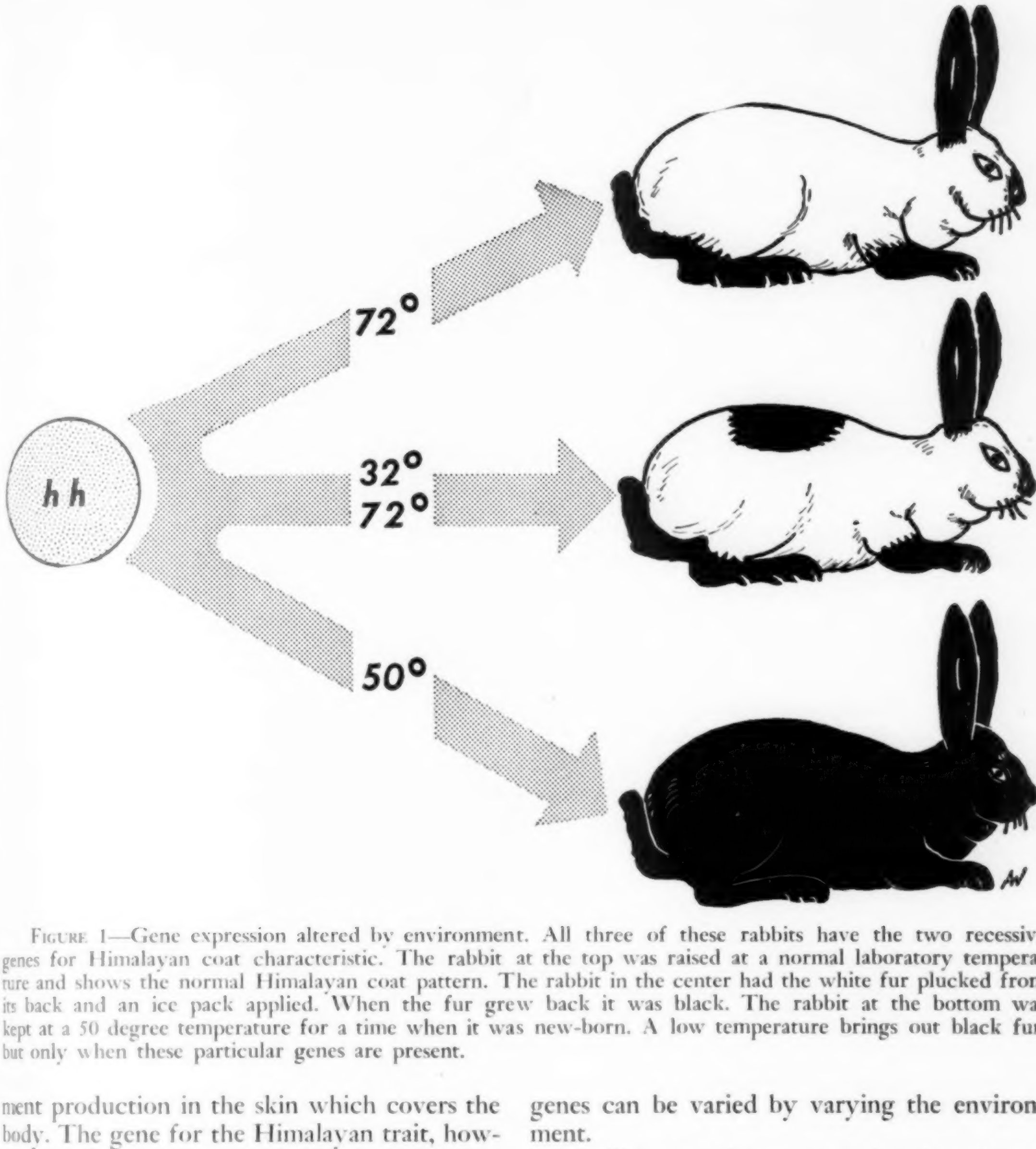

FIGURE 1—Gene expression altered by environment. All three of these rabbits have the two recessive genes for Himalayan coat characteristic. The rabbit at the top was raised at a normal laboratory temperature and shows the normal Himalayan coat pattern. The rabbit in the center had the white fur plucked from its back and an ice pack applied. When the fur grew back it was black. The rabbit at the bottom was kept at a 50 degree temperature for a time when it was new-born. A low temperature brings out black fur, but only when these particular genes are present.

ment production in the skin which covers the body. The gene for the Himalayan trait, however, produces an enzyme-inhibitor which prevents the pigment-producing enzyme from functioning as long as the skin temperature is 92 degrees or higher. When the temperature drops below this point the genes, or the inhibitor, become inactive and the enzymes produce the black pigment. Regardless of the exact explanation for these effects, it is clearly evident that we have a blending of the influence of both heredity and environment. It requires both the genes and certain temperature conditions to produce the typical Himalayan coat pattern and the effect of the genes can be varied by varying the environment.

To illustrate the reverse situation, let us take the vitamin-deficiency disease of rickets. Here is a characteristic which appears to be due to environment. An animal receives a subminimum quantity of vitamin D and rickets develops—apparently a simple case of cause and effect. As we learned in the illustration with the rabbits, however, we must not be too hasty in drawing conclusions about heredity and environment. Carefully controlled experiments on rickets in rats have been performed with very interesting results. Most laboratory workers on deficiency diseases have

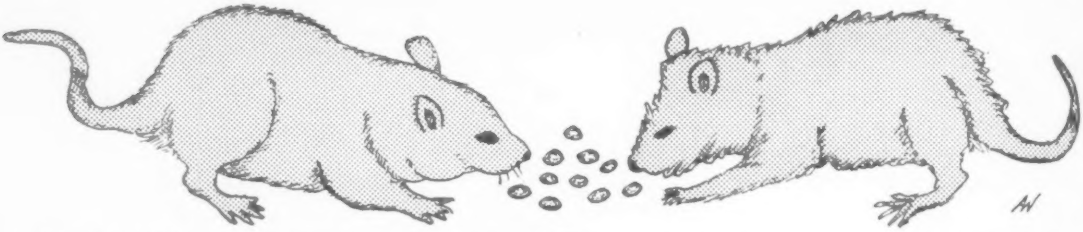

FIGURE 2.—Effect of environment altered by genes. These two rats are of the same age and sex and have both been fed on a diet slightly deficient in vitamin D. The rat on the left is fat and healthy-looking while the one on the right shows symptoms of rickets. Genes make the difference—the rat on the left is from a strain selected for rickets resistance while the rat on the right comes from a strain selected for rickets susceptibility.

observed that whenever a group of rats are fed diets deficient in certain vitamins they do not show the same response. Some rats will develop normal bone structure on a diet low in vitamin D, while others of the same age and body weight will develop symptoms of rickets on the same diet. Could differences in heredity play any part in this? A series of experiments was conducted to determine if they do. There was careful selection for a strain of rickets-resistant rats for fourteen generations. At the same time there was a similar selection for rickets-susceptible rats for a like number of generations. When these selected strains were placed together and fed on a diet slightly deficient in vitamin D, it was found that all the rats of the susceptible strain developed severe rickets while those of the resistant strain were hardly affected. From these results we can conclude that genes are somehow connected with the utilization of vitamin D and that this is another case where there is a blending of the influence of heredity and environment.

To show how opinion may vacillate from one extreme to the other when the full picture of heredity and environment is not kept in mind, let us take the case of Mongolism (Mongolian idiocy) in man. Statistics show that about one out of every 1,000 births results in a child afflicted with Mongolism. Such a child has certain abnormalities of the face, tongue, eyelids, and body build which are characteristic of this condition. The name Mongolism was chosen because there is often a fold of the eyelid which gives a superficial resemblance to members of the Mongolian race. The trait is accompanied by a very low mentality, and the birth of a child with Mongolism is a major tragedy in any family.

There was a time when it was thought that this condition was brought about because of inheritance alone—it was even postulated that it was introduced into the Caucasian race by some mingling with Mongolian genes in the past (a postulation with no basis in fact). In the course of time, however, it was found that the number of Mongolian children born to older mothers was much higher than was found among children of younger mothers. Women past forty years of age bore between 30 and 40 Mongolian idiots per thousand children rather than about one per thousand as is found in the average births of all mothers. As this information became known some scientists swung to the opposite viewpoint, and the concept became prevalent that heredity had nothing to do with the occurrence of Mongolism. It was suggested that, with the increasing age of the woman, there were probably some degenerative changes which caused the production of defective eggs or defective nourishment of the embryo, and this was the cause of Mongolism.

A more carefully balanced analysis indicates that the true explanation lies somewhere in between the two extremes. While it is true that Mongolism is much more frequent during the latter part of a woman's period of fertility, it is just as true that Mongolism appears frequently in some family lines and is practically unknown in others. It is more logical, therefore, to assume that heredity plays an important part in creating the conditions of environment which cause this abnormality to appear.

Fortunately, for the study of heredity and environment in man, there are twins of two different types which give us an excellent indication of the relationship of these two agents

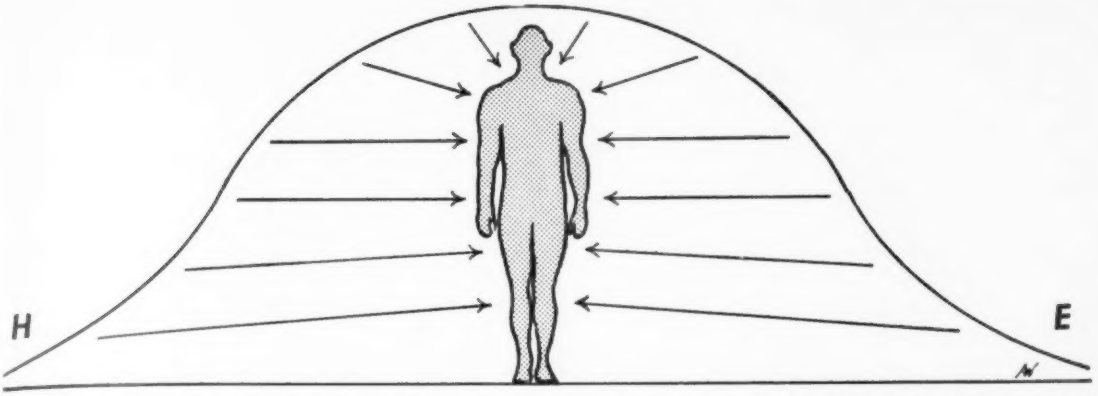

FIGURE 3—Human characteristics, tabulated as to the relative influence of heredity and environment, fall into a bell-shaped curve as illustrated. A few characteristics, represented by the left side of the curve, come mainly from genes and are little influenced by environment, while those on the right are due mainly to environment with little influence of genes. The great majority of the characteristics, however, lie in the main body of the bell where there is a strong influence of both heredity and environment in the total expression of the characteristic.

in the development of human characteristics. The so-called identical twins begin life as a single individual which becomes divided and forms two complete bodies. With this common origin, a pair of twins of this type has the same kind of genes and any differences which they show, therefore, are produced by differences in environment. Fraternal twins, on the other hand, begin their lives as two separate individuals and need be no more alike in their genes than brothers or sisters born at different times. By the law of averages, fraternal twins will have a 50 per cent similarity in their genes as compared to a 100 per cent similarity among the identical twins. Here we have an excellent basis for evaluating the effects of heredity, provided we eliminate the great differences brought about by sex. Fraternal twins may be of different sexes, hence we must always use only those fraternal twins of the same sex when we make comparisons with identical twins which are invariably of the same sex.

Space here does not permit even a cursory survey of the many findings which have come about as a result of twin studies, but let us take a few cases which show how heredity is often involved in traits which may appear to be due solely to environment. Schizophrenia is a mental defect which often seems to be brought about by extreme emotional stress, and an environmental cause is accepted by many. But, let us see what twin studies reveal about this disease. Among the many schizophrenics in our hospitals for the mentally ill, there are some who have twin brothers or sisters. One extensive study of such cases showed that when a person so afflicted had an identical twin, then in 68 per cent of the cases this twin also had schizophrenia. When an afflicted person had a fraternal twin of the same sex, however, it was found that in only 11 per cent of the cases was this twin also afflicted. We can hardly deny some influence of genes in the face of such evidence.

In the case of tuberculosis, which certainly is caused by an environmental agent (bacteria), the twin studies show that there is a definite inheritance of susceptibility to this disease. Identical twins show a correlation of 65 per cent for this disease, while the fraternal twins of the same sex show only 25 per cent. The influence of heredity on vitamin requirements is again brought out by the twin study on rickets. There is an 88 per cent correlation among identical twins and only 22 per cent among fraternal twins. Sugar diabetes shows a correlation of 84 per cent and 37 per cent respectively. Even in such a complex trait as criminality we find that heredity plays its part. When one twin has a criminal record we find, according to one reliable study, that the other twin will also have a criminal record in 68 per cent of the cases if the other twin is identical. When the other twin is fraternal,

and of the same sex, the chance of a criminal record is 28 per cent.

Thus, as more studies give us a better insight into the action of genes and the environment, it becomes more and more apparent that each plays a part in almost all traits. A better understanding of the relationship of the two might be obtained if we compare the genes to the various craftsmen who build a house, and the environment to the materials from which the house is built. The craftsmen have the power to build, but are helpless without materials with which to work. Likewise, no matter how good the materials, they cannot assemble themselves into a house without the builders. Poor craftsmen will build an unsatisfactory house no matter how good the materials and excellent craftsmen cannot build a good house if they are given poor materials with which to work. We cannot say which is the most important of the two—both have a very necessary yet different sort of role to play. Neither can we say that one part of the house is well made solely because of the good materials which went into it and another part is well made solely because of the skill of the workmen. It is true that in certain parts of the house, labor may play a more important role and in other parts the materials may be more vital than labor, but we could not do without either in any part of the house.

The rather scattered illustrations which we have chosen are designed to emphasize the point that characteristics are not independent of either heredity or environment even though the relative influence of each may vary. If we were to tabulate all the human characteristics we could think of and assign to each a figure indicating the relative influence of heredity as compared to environment, we would find that they would fall within a bell-shaped curve. Some traits, such as eye color, would be listed near the end of the curve indicating a more important role of heredity; other traits, such as skill in piano playing, would lie near the other end where environment plays a major role. The great majority of characteristics, however, would lie in between where there is a more equal blending of the two. With such a viewpoint there is no room for argument about the relative value of heredity and environment. With such an explanation as we have tried to present we hope that a teacher can develop an understanding of the subject in the minds of students so that they never again will ask, "Which is more important, heredity or environment."

Homefront Conservation

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It appears that many of us become involved in studying "great problems" in conservation too frequently and forget what is close at hand. The author has heard students in biology classes explain, with an air of authority, the conservation problems of the Pacific Northwest lumbering area, the resources of the deep South, and the value of price-supports to the midwest farmer. Also opinions on world problems in conservation could be given intelligently. It seemed, from this writer's observations, that the students possessed a great deal of information about things far from home area. When asked about the problems in the home area, however, they were able to deal only in generalizations.

An attempt was made at the Iowa State Teachers College in a conservation class to overcome this "lack of knowledge of the homefront." The following are two examples of activities used with some success.

Each student was asked to choose an area near his home. It was suggested that the area should be small and easily accessible. In fact it was hoped that the area would be one which the student passed by each day. Some of the areas chosen were: the lawn, a roadside ditch, a small urban park, a large marsh, a section of a stream. A map of the area under observation was made by each student. Outstanding landmarks in the area were noted on the map. The locations of many of the larger plants were given. Students were asked to keep a diary of all observations in the area. Any changes of a seasonal nature were also recorded. The written report of the experience included: (1) a description of the area under study, (2) the map of the area, and (3) the diary of observations.

A second suggested activity involved a study of the resources of the student's home county. Since the primary socio-economic, political and governmental unit in Iowa is the county, the students were asked to use this as their area for study. Their research was to include:

1. A map of the home county.
2. A description of the principal rivers and streams, if any.
3. A map showing location of the home county in the State.
4. A description of the topography of the county.
5. A description of the location of the county-seat.
6. A statement indicating the population of the county with a breakdown as to numbers rural, and numbers urban.
7. A report of the soils of the county including both the location and extent of soil types and soil association.
8. A statement indicating the principal crops produced in the county.
9. A statement indicating the livestock and its value produced in the county.
10. A survey of the timber resources, if any, in the county.
11. A list of the names and addresses of State and Federal conservation personnel in the county. To be included are persons such as the U. S. Soil Conservation Service Work Unit Conservationist, the Conservation Officer, the County Extension Director.
12. A list of the Sportsman's Clubs of the county with a description of their conservation-education activities.
13. A list of the names and addresses of some outstanding farmers in the county.
14. A list including names and locations of the principal cities in the county with a statement describing their principal industries.
15. A list of the public recreational areas in the county with a description of their recreational opportunities.

Both of these assignments were made at the beginning of a quarter, so each student had about 11 weeks to complete each study. The author was pleased with the results obtained from both assignments, in most cases.

Keys for Your Classroom

BONITA L. BERKA
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Iowa State College

Don't overlook the use of plant and animal keys in teaching your biology pupils. They can be as helpful as charts and specimens, and they are much cheaper.

Plant and animal keys such as those compiled by H. E. Jaques are indispensible to the biology classroom. Yet schools can hardly afford copies for each pupil. Why not construct simple keys yourself, and have them stenciled for your pupils?

But, you may ask, of what particular value will keys be to me in my teaching? The answer can be illustrated by a simple example.

You probably have asked your pupils, at one time or another, to identify the community trees and to make leaf identification notebooks. But trouble usually arises because problems in identification are frequent. For example, what are the different species of maples? Is this the leaf of a hard sugar maple, a Norway maple or a black sugar maple?

Students who know how to use keys and have them readily available will be able to answer such questions for themselves.

The following key illustrates the differences in the maples.

1. Sap milky — *Norway Maple*
1. Sap not milky
    2. Twigs and buds reddish
        3. Leaves deeply lobed—over half way to the base; twigs and buds reddish — *Silver Maple*
        3. Leaves less deeply lobed; twigs and buds bright red — *Red Maple*
    2. Twigs and buds grayish brown
        3. Leaves with five definite lobes; smooth below; buds smooth, yellowish — *Sugar Maple*
        3. Leaves with only three definite lobes; hairy below; buds hairy, darker, not yellowish — *Black Maple*

This is known as a dichotomous or two-choice key. In identifying a plant or animal, a person has only one of two choices to make. From choice number one, he moves on to two and so on until the plant or animal is "keyed out." This type of key is easy to use and just as easy to construct.

A student, after using keys for awhile, will no longer stop at a tree and falteringly ask himself "What is it?" Instead, he will analyze

and automatically ask himself: "Are the leaves simple or compound?" "Are the buds opposite, alternate or whorled?" And thus he will reason from point to point until he has identified (for himself) that particular plant.

Perhaps you are already well acquainted with the make-up of keys. If you are not, get a simple key and study its construction. After you once get the knack of its construction, try building one yourself. You might want to practice by classifying some of the common plants and animals in your own community.

By emphasizing to your students the need for knowing plants and animals as individuals, you will help a student develop logical reasoning. So make your own keys, and let your students use them. They will have fun; and so will you.

Summer Graduate Study for Biology Teachers

VICTOR A. GREULACH
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University of North Carolina

High school teachers of biology and other sciences frequently take master's degrees entirely in education, even though they may want additional work in the sciences as well as education. One reason is that the science courses likely to be of greatest value to the teachers are often undergraduate courses which do not contribute toward a master's degree. Another is the rather limited number of graduate courses in the sciences offered by most summer schools, and the fact that many of those offered are either unavailable to teachers because of prerequisites or are of little value to the high school science teacher. Also, it is usually difficult if not impossible to complete all the requirements for a master's degree in a science during the summer sessions alone.

These were among the many points brought up and discussed at the Southeastern Work Conference on the Teaching of Biology which was held in Gainesville, Florida, last summer. The Conference recommended that colleges and universities should offer more summer courses in biology and other sciences at the graduate level, including special courses for teachers which would include essential subject matter frequently available only at the undergraduate level. It also suggested that programs be established which would permit securing a master's degree in science and education during the summer sessions.

Several Conference participants objected to the offering of graduate courses which include subject matter usually offered at the undergraduate level, on the grounds that it would lower the quality of graduate work. However, most participants seemed to feel that almost any of the undergraduate subject matter in the sciences could be offered to a group of graduate students in such a way as to meet graduate standards and justify graduate credit. There was also rather general agreement that frequently such subject matter is what the biology teacher needs most. For example, a biology teacher who secured his training in a college where little or no botany is available, even in the general botany course, would perhaps benefit more from a course including the fundamentals of botany than from any other single course he might take. However, human nature being what it is, it is quite unlikely that he would spend his time and money taking such an undergraduate course which would not count towards his master's degree. Instead, he might take a course which would be of relatively little value to him.

The University of North Carolina anticipated all of the above recommendations of the Conference and has now in operation a summer program of graduate study for teachers of science quite similar to the one recommended. In addition to a variety of summer graduate courses in education and the sciences, especially botany, the University is now offering each summer a series of special graduate courses in the sciences (and in English) for high school teachers only. The first special courses were offered during the summer of

1953, and during the summer of 1954 special courses were offered in chemistry (two courses), physics, mathematics (four courses), and zoology. During the summer of 1955 a special course in botany, to be offered by the writer, will be added to the list as will a second course in zoology.

Since these courses are designed for high school teachers, rather than for the preparation of research scientists or college teachers, they stress subject matter of value to the high school teacher, including a review of many fundamentals. Recent developments in the various sciences also receive attention. The laboratory work stresses the development of experiments, demonstrations and projects useful in high school teaching. Many high school biology teachers would profit by taking, not only the botany and zoology courses, but also those in chemistry and physics, particularly if they also teach general science.

In addition to the recently-developed special course in botany for high school teachers, the Botany Department also offers the following regular graduate courses at least once every three summers: Taxonomy of the Flowering Plants, Introductory Plant Physiology, Plant Ecology, and Dendrology. These particular courses have been selected because they are regarded as being particularly valuable for high school teachers. With the exception of plant physiology, they all conform to another recommendation of the Conference: that the preparation of high school biology teachers should include considerable field work. North Carolina, with its mountains and seacoast and intervening Piedmont, is an excellent location for field studies, and the native plants include many species common both farther north and farther south.

Both the special courses in science and the courses in botany may be used in working toward the degree of Master of Education. (At present the other science departments offer only a limited number of regular graduate courses of interest to high school teachers.) The Master of Education degree differs from a Master of Arts or a Master of Science degree in that a first class teaching certificate as well as a bachelor's degree is required for admission, either the major or the minor must be in education, and a thesis is optional rather than required. A written comprehensive examination is required; and if a thesis is written, there is also an oral examination on it. The minimum residence requirement is one year, or three full twelve-week summer sessions. Thirty semester hours of graduate work are required, at least 18 of them in the major and at least 6 in the minor.

The courses offered at present permit a biology teacher to take his major in either botany, science, or education. With a botany or science major it would be necessary to take an education minor. With an education major, the minor could be in either botany or science. The science major could be composed entirely of courses in botany and zoology, or it could also include chemistry and physics. Teachers of the physical sciences and mathematics can take enough courses in chemistry, physics, and mathematics to constitute a science major, if they wish. It is also possible to make considerable progress toward a Master of Arts degree in botany during the summers, though at present not all the course requirements for this degree can be met during the summer sessions alone.

Although the requirement for the Master of Education degree is 30 semester hours, practically all teachers will have around 40 hours of credit by the time they meet the minimum residence requirement of three full summers of work, particularly since all the laboratory science courses carry four instead of the usual three hours credit. This will permit a considerable number of electives, or additional courses in the major or minor beyond the minimum requirements. It would be possible to include among these, undergraduate science courses, which would count toward establishing the residence requirements, although they could not be included in the 30 hours required for the master's degree. Several summer scholarships for teachers are also available.

The University of North Carolina believes that its special summer program in the sciences will contribute considerably toward the training of high school science teachers, and is pleased that the program is so nearly in line with the recommendations of the Southeastern Work Conference on the Teaching of Biology.

Antidote for Formalin

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Williamstown, Massachusetts

(Continued from December issue)

Mollusks

Gastropods provide material for a number of demonstrations. These include: the method of locomotion, the operation of the radula in feeding, and the presence of larval flukes in many of the water-living snails. Pelecypods, too, are useful for demonstration. The following suggestions deal with such pelecypods as the freshwater clams, *Unio* and *Anodonta*.

27. *Role of the Siphons.* A single clam is placed in a dish of water resting on a white background, and allowed to remain undisturbed for several minutes. A pipette is filled with dilute carbon ink. As soon as the siphons are extended, the tip of the pipette is introduced below the surface of the water, and a drop of ink allowed to descend close to the tip of the ventral, or incurrent, siphon. A portion of the ink will be observed to enter the siphon. In fifteen or twenty seconds, the ink is dispelled from the excurrent siphon in a dispersed, fan-shaped spray.

28. *Ciliary Action.* The mechanism responsible for the water currents in the siphons can be shown by placing a small piece of living gill on a slide, covering it with clam juice, adding a minute amount of carbon ink, and applying a coverglass. Under the microscope, the vigorous beating of the cilia can be observed. It will be further noted that tiny carbon particles have been engulfed by masses of mucus, and that these masses show streaming movements as a result of ciliary action.

29. *Rate of Heartbeat.* A large clam should be selected, the adductor muscles cut, and one valve carefully removed. Next, the pericardium is opened to expose the ventricle. A spotlight may be focused on the heart, and the heartbeat watched under a hand lens. When warm 0.6 per cent NaCl solution is dropped from a pipette upon the heart, the beat is accelerated. When cold solution is applied, the beat is abruptly checked, then continues at a lower rate. By applying solution at several known temperatures and counting the heart beats, one can readily plot a graph showing the effect of temperature upon the action of the heart.

30. *Glochidia.* Frequently one finds a clam whose gills are gorged with larvae. These glochidia, if well developed, display sharp movements. At intervals, the single adductor muscle of a glochidium contracts quickly and closes the valves. When this muscle relaxes, the elasticity of the hinge ligament causes the valves to gape. The snapping action is best seen if a large number of the larvae are placed in a drop of water on a slide, and examined under low power. The significance of these movements in the establishment of glochidia as temporary parasites on fishes is obvious.

Crustaceans

Many experiments with crustaceans require specialized apparatus. The suggestions given below deal with common laboratory forms and simple equipment.

31. *Daphnia Cultures.* Numerous methods for rearing *Daphnia* have been recorded. All are designed to produce an abundance of bacteria, non-filamentous algae, or other minute plant organisms on which the crustacean feeds. Any material which fosters bacterial growth, such as horse dung, sheep manure, or decaying water plants, may be used.

One of the simpler methods involves the use of lettuce leaves (Hyman 1937). Her method is somewhat modified in the following account. A leaf is blanched by dipping it into boiling water, then transferred to cool water in a culture dish. In two or three days, daphnids from a thriving culture should be introduced. From time to time pieces of crushed lettuce leaf may be added. Entrails from tadpoles, frogs, or mice may also be introduced. The amount of material added must be carefully limited to avoid clouding or fouling the culture.

Another simple method makes use of fresh yeast suspension (Bond 1934). For small cultures the method may be modified, as follows. A small piece of fresh yeast the size of a pea should be mixed with five ml. of water. A drop of this suspension is added to a dish of water and daphnids introduced. More should be added as fast as the slight cloudiness of the culture disappears.

Some writers stress the importance of exposing *Daphnia* cultures to full sunlight: this

doubtless favors the production of algae which serve as food. Others make no mention of this as a necessity. Indeed, the writer knows of one person who raises cultures successfully even in decidedly weak light. This doubtless favors bacterial growth. When *Daphnia* cultures begin to decline, the animals should be removed by use of a fine-meshed net and transferred to fresh culture medium.

The ingestion of food may be demonstrated by placing a single animal on a depression slide, adding a small amount of yeast suspension, and enough water to fill the depression. A coverglass is then applied. Under low power, the method of feeding, and the progress of the yeast plants through the digestive tract may be observed. Under slightly reduced lighting the pulsation of the heart is easily seen.

32. Artemia Cultures. Eggs of the brine shrimp, *Artemia* may be secured from biological supply houses. They are extremely small brown spherules; a thimble would hold scores of thousands. The animals may be cultured in sea water concentrated by evaporation. The writer has reared them in solutions of rock salt with concentrations ranging from 6 to 12 per cent.

Jars of culture fluid should be prepared and seeded sparingly with eggs. In 24 hours or less, the young larva normally emerges. The process of emergence includes two phases: excystment, and hatching. First, the heavy outer capsule bursts, exposing a delicate, membranous sac, enclosing the animal. Then the sac is ruptured and the brine shrimp appears as a free-swimming nauplius larva. Yeast suspension should then be added to the culture. *Artemia* is a vegetable feeder and will thrive on yeast or non-filamentous algae. The animals pass through a series of stages and become sexually mature in about a month.

A wide variety of experiments and demonstrations are possible with the brine shrimp. Studies can be made on the effects of salt concentration on hatching, body form, and time required to reach maturity. The responses to light are of interest. *Artemia* is positively phototropic. It swims on its back when the light is above, but swims back-side up when lighted from below (Lochhead 1941). Lochhead's paper gives much interesting detail concerning the brine shrimp. Under the microscope the nauplius furnishes an excellent example of an interesting and significant crustacean larval form. More advanced stages are suitable for demonstrating the pulsation of the heart and the circulation of the conspicuous blood corpuscles.

33. Crayfish. The direction of the flow of water over the gills, and the resultant change in the pH of the water are two phenomena that can be easily demonstrated.

A crayfish is placed in a dish of water resting upon a white background, and allowed to remain undisturbed for a few minutes. Then the tip of a pipette filled with dilute carbon ink is thrust into the water and a drop of ink allowed to settle near the posterior edge of the carapace. The bailing action of the scaphognathites moves the inky water forward through the gill chamber and out into the area in front of the animal.

That water passing through the gill chamber has been chemically changed may be shown. Place a crayfish in a closely fitting bottle or tube so that its movements are restrained. Then fill the container with water, to which has been added a few drops of phenol red solution 1:2000. The solution should at first be a distinct pink. In a few moments the water in front of the crayfish will become yellowish, indicating that the pH has been lowered. From this it may be inferred that carbon dioxide has been added to the water as it passed over the gills. To prove this, add a few drops of five per cent barium hydroxide solution to the water. Barium carbonate will soon appear as minute white particles encrusting the hairlike projections of the anterior appendages.

Insects

34. Tracheal System. The tracheal system may be shown in the larva of *Drosophila*. The entire animal may be killed by heating, cleared in glycerine, and mounted in a flattened condition on a slide. A still simpler demonstration involves the use of the larva of the "mealworm" beetle, *Tenebrio molitor*. The entire digestive tract may be removed by pulling on the head with a twisting motion. A needle rolled over the surface of the intestine will remove the food material. If desired, the intestine may be split, but a whole mount

will be entirely satisfactory. The entire surface of the gut is richly supplied with tracheae. Under high power, the spiral thickening in their walls can be seen. In such preparations, collections of fat cells, and numerous, brown Malpighian tubules are often present.

35. Parasitism. The larva of *Tenebrio* is commonly infected with gregarines. These protozoans are present in the anterior portions of the digestive tract, and may often be seen as sporonts, paired end to end. Similar forms are present in crickets and grasshoppers.

Grasshoppers, such as the red-leg hopper, *Melanoplus femurrubrum*, are often infected with larval stages of the "hair snake" *Gordius*. As high as six per cent infection has been observed. If 50 or 100 grasshoppers are placed in a screen cage with an inch of wet sand on the floor, the parasites soon emerge and appear as tangled masses of cream-colored thread. When placed in water they exhibit characteristic undulating swimming movements. In a short time they reach maturity.

36. Feeding. The mechanics of feeding by vegetation destroyers may be determined by placing a grasshopper and a few blades of grass in a glass jar. The animal orients itself lengthwise of the leaf, and straddles its edge. The labial and maxillary palps explore the leaf and adjustments are made until its edge lies in the median groove of the labrum. Through the combined chewing action of the mandibles and movements of the head, a crescent-shaped segment is devoured. The grasshopper then advances or retreats slightly and the process is repeated. The rate of feeding and the amount consumed may be readily computed. When multiplied by thousands of individuals, the results give significance to the expression, "grasshopper plagues."

Vertebrates

A great many demonstrations and experiments using vertebrates are possible and are well-known. To discuss even few of them would unduly extend this paper. One experiment, using the frog, must suffice.

37. Respiratory Movements in the Frog. This animal is of special interest because variations in its seasonal and its daily oxygen requirements bring into play one or more of the respiratory areas—the skin, buccopharyngeal surfaces, and lungs.

A team of four persons is a minimum requirement for this experiment. One serves as a timekeeper, another counts the movements of the nostril caps (nasal valves), a third counts the movements of the floor of the throat (buccopharyngeal movements), and the fourth counts the sharp movements of the abdomen just behind the forelegs. For a closer approach to accuracy, it is preferable to have two observers for each type of movement, making a team of seven. A frog is placed under a bell jar and allowed to remain undisturbed for several minutes. At a word from the timekeeper, the observers count the movements for a period of exactly two minutes. Results are recorded. If two or more teams are operating, the results of each may be recorded on the blackboard, and averaged. The frog is then "exercised" by making it hop continuously for three minutes. Then it is returned to the bell jar and the movements counted for two minutes, as before.

When the results are examined, several striking facts will be noted. *First,* the number of movements of the nostril caps is the same, or nearly the same, as the number of movement of the abdomen. This is true both in the resting frog and in the exercised frog, and indicates a relationship between the two movements. *Second,* abdominal movements of the resting frog form only a small percentage of the total movements (abdominal, plus buccopharyngeal). *Third,* the total respiratory movements are much greater in the exercised frog than they were in the resting frog. *Fourth,* abdominal movements of the exercised frog form a large percentage of the total respiratory movements.

In the discussion that follows the completion of this experiment, it can be pointed out that the hyoid apparatus in the floor of the throat is responsible for buccopharyngeal movements. When the nostrils are open, the air passes in and out of the buccopharyngeal cavity. When the nostril caps close as the floor of the throat is rising, air is forced into the lungs, with a resultant sharp movement of the abdomen. This explains why the nostril caps and the abdomen move the same number of times.

Further class discussion may be used to relate all these facts to the variation in oxygen demand, not only in the daily activity, but also in the seasonal cycle.

Summary

This paper has presented a series of demonstrations and experiments selected on the basis of simplicity, use of common apparatus, and effectiveness in stimulating student interest in biological structures and functions.

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Biology Appreciation

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Our schools offer art and music appreciation courses, so why don't they emphasize biology appreciation? Such an approach would differ from the traditional biology course in that greater emphasis would be placed on the wonders of biology with the aim of creating a greater respect or even awe for the marvels of Nature's creations, with the hope that religious faith might be strengthened. This has not always been so, even in our own century, for it has been common in the past when biology was new in the school curriculum for church elders and parents to believe that the youth who left their care would become agnostics or atheists if they came under the influence of biology professors.

Happily this situation is just the reverse now that more and more students are learning biology in schools. They realize that a scientific study of life increases one's belief in The Maker of that life. Added emphasis on this fact and a deliberate attempt to illustrate it will result, I have found, in a revitalized teaching and outlook on life. An anonymous sage once said that to see God in everything makes life the greatest advantage there is.

Of course some science teachers still believe that it is unscientific to mention the word "God" or "Creator," and these will write learned books about our physical and biolog-

ical universe without once giving any credit to The Maker of it all or even alluding to Him. As we all know, volumes have been written concerning scientific theories that were controversial, in the first place, and which later proved to have serious errors. Is it less scientific to write or speak of a God of creation and to be enthusiastic about His works?

Many authors of physical science textbooks have taken advantage of the marvels inherent in their subject matter as evidenced by the liberal use of exclamation points in their books. They exclaim like Ripley did in his *Believe It Or Not* over the extremely large and the extremely small in the universe, in the power of the atom, in extremes of densities, temperatures and other physical characteristics. Most teachers would agree that this is good pedagogy. I believe that biology surpasses every other subject matter area in the number and degree of its marvels, but that we as teachers have not been taking as great an advantage of them as we could. Let us examine just a few of these.

Consider that it takes tons of blueprints for the construction of a battleship which we recognize as a most complicated piece of man-built machinery. Now compare the plans for the development of a vastly more complex structure, a human being. These plans, we know, are in the genes and chromosomes of the zygote which is microscopic in size. Contemplation of this fact and a full appreciation of it cannot but produce a feeling of awe.

Another phase of this process that excites our wonder is that of mitosis. What is the mechanism that enables that microscopic, thread-like material to split longitudinally so that there is an equal division of inheritable substance? Again, how can these threads produce the proper chromosome number, line up during the metaphase, then be drawn towards their respective poles? Of course all of this is old stuff to biologists, but have we ceased to marvel at it, and more important, to communicate this sense of admiration to our students? Or think of the selective action of a cell membrane that will admit some large molecules yet keep out certain smaller ones. What is the basis for the accomplishment of this action?

Do we take the color and fragrance of flowers for granted? Then let us remember that some of the highest forms of thallophyte plants reproduce without flowers. Maple trees, oaks, the corn plant and the like, for example, have no apparent need for color or perfume in their flowers yet they reproduce as well as roses or violets. Let us recognize this beauty as a gift of God.

Another gift of The Creator is the thrilling color of the autumn foliage in northern latitudes. Since comparatively little is known of the function of the xanthophyll and anthocyanin other than that they are usually present in autumn leaves to help produce the colors characteristic of the Fall season, how else should one interpret this?

How about the bright colors and melodious songs of birds? Are they not biologically illogical since they prevent camouflage and advertise the animals' presence to their enemies? To the cynic who may point out that many of our song birds sing merely to post or to warn other birds to stay away from their feeding area, the answer might be given that such warnings could just as well be raucous crowing or other unmelodious sounds. Clearly, this may be viewed as another gift of The Creator for our enjoyment.

One could go on in this way much more, but the point to be made here is that it would do us and our students good to refresh our outlook on biology by cultivating an attitude of wonderment and appreciation for Nature's marvels to the extent that we develop a sense of mission about it. By this is meant that we may have a conviction that our work is contributing to a deeper religious faith, a higher morality and a greater enjoyment of life. This gives a new meaning to biology teaching.

The rate of growth of infants, especially those with poor appetites, has been "substantially improved" by small additional amounts of an essential amino acid lysine in a typical diet, Dr. Anthony A. Albanese, chief of nutritional research in the Nutritional Research Laboratory of St. Luke's Hospital, Greenwich, Conn., told a meeting of the American Chemical Society. Amino acids are the units which make up proteins.

Strictly On The Record!

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The history of the recording of natural sounds dates back only about 20 years when Cornell University ornithologists were asked for advice on obtaining songs of some wild birds. Prof. Arthur A. Allen, knowing that individual birds tend to move in definite sequence from one song perch to another, was able to predict where and when a given bird would appear at a specific place, and thus microphones were set up in advance to await the songsters. To the amazement of the recording crew, and to the gratification of Dr. Allen, the chosen birds performed as he had predicted, and the experiment was a success.

Bird song recording became a full-scale project at Cornell shortly thereafter, when Dr. Allen and his colleague, Dr. Peter P. Kellogg, began work in earnest on techniques of recording the sounds made by wild birds and other animal species. With the backing of the Albert S. Brand Foundation, the two ornithologists assembled a half-ton of equipment and lugged it around by truck. The microphone alone proved inadequate. First, it had to be so close to the singing bird that it tended to alarm and silence him; second, it was so sensitive that it picked up extraneous sounds as well as the selected song. These problems were met by the acquisition of a parabolic reflector, which could pull together sound waves from some distance, thus avoiding the necessity for having the equipment too near the bird. By placing the microphone at the focal point of the reflector, it became possible to obtain a concentration of the bird's sounds, and to shut out other sounds coming from different sources. As time passed, the recording techniques continued to improve while the weight of the equipment lessened, so that today, one man can carry around the 20 pounds of sensitive recording equipment with ease.

Public interest in the products of these endeavors has increased steadily. Bird song records are used commonly in schools and colleges as aids to bird study, and their reception in homes, music appreciation classes and other places has become phenomenal. Today, we can hear the songs, calls or other sounds of birds, frogs, toads, tortoises, fish, shrimp and insects—all on record. Special sets of color slides have been prepared to accompany some recordings, and Dr. Allen's colorful, magnetic sound film, HUNTING WITH A MICROPHONE AND COLOR CAMERA, provides a fascinating documentary of natural sound recording.

In the accompanying list of natural sound recordings currently available, the sources and titles are noted first, followed by comments about the records.

Cornell University Records, 124 Roberts Place, Ithaca, N. Y.:

AMERICAN BIRD SONGS (Volume I): Drs. P. P. Kellogg and A. A. Allen.

Album of six 10-inch, 78 r.p.m. records; 72 birds of the northwoods, of northern gardens and shade trees, of southern woods and gardens, of fields and prairies, of western North America, and North American game birds. Each song is announced. $8.50

AMERICAN BIRD SONGS (Volume II): Drs. P. P. Kellogg and A. A. Allen.

Album of five 12-inch, 78 r.p.m. records; 52 birds of gardens and shade trees, of roadsides, of lakes and marshes, and some warblers. Records are banded, to permit easy selection of any one song; announcer gives interesting information about each bird. Superb sound reproduction. $10.50

VOICES OF THE NIGHT: Drs. P. P. Kellogg and A. A. Allen.

One 12-inch, 33-1/3 r.p.m. record; 34 frogs and toads of the U. S. and Canada; an expanded revision of an earlier 78 r.p.m. album. Name, location and recording date are announced for each species. $6.75

MUSIC AND BIRD SONGS: Dr. P. P. Kellogg and James H. Fassett.

One 10-inch, 33-1/3 r.p.m. record; 10 bird and six frog voices presented to bring out their musical qualities, sometimes by slowing down the songs to fractions of their natural speeds. Excellent commentary and musical analysis by Mr. Fassett. $5.00

FLORIDA BIRD SONGS: Drs. P. P. Kellogg and A. A. Allen.

One 10-inch, 78 r.p.m. record; five common and five hard-to-find birds of Florida and the southeast. Disc is banded to permit easy selection of songs. $2.50

Book-Records, Inc., 680 Fifth Avenue, New York 19, N. Y.:

SONGBIRDS OF AMERICA IN COLOR, SOUND AND STORY: Drs. A. A. Allen and P. P. Kellogg.

Either a 10-inch, 33-1/3 r.p.m. or a 45 r.p.m. extended play record, contained in a Soundbook. Book contains authoritative information on many bird topics, superb color photographs of the 24 common birds recorded, and detailed information on recognition, habits and song of each of these birds. The record is conveniently banded, has excellent song reproductions, and is featured by Dr. Allen's commentary on ways of recognizing each bird song. $4.95

Ficker Recording Service, Box 883, Old Greenwich, Conn.:

BIRD SONGS OF DOORYARD, FIELD AND FOREST (Volume I): Jerry and Norma Stillwell.

One 12-inch, 33-1/3 r.p.m. record; 48 birds represented by fine song reproductions. Grouping of songs of related species, and inclusion of song variations within a species are worthy of note; interesting commentary. $7.95

BIRD SONGS OF DOORYARD, FIELD AND FOREST (Vol II): Jerry and Norma Stillwell. $7.95.

One 12-inch, 33-1/3 r.p.m. record; 58 bird species represented, with songs grouped according to their similarities, to afford comparison. Analysis of song is simplified by slowing down speed of phrases, then repeating phrases at normal speed. Fine recording and commentary.

NATURE WHEEL NO. 1: Anon. $1.00

One 7-inch, 78 r.p.m. record; 24 common birds heard in brief song samples. Sound reproduction quite good, but not up to the high standards of previously-listed recordings. The nature wheel makes an interesting game out of learning the appearance, habitat and range of each bird.

Folkways Records and Service Corp., 117 West 46th Street, New York, N. Y.:

SOUNDS OF A TROPICAL RAIN FOREST IN AMERICA: Recorded by many individuals.

One 12-inch, 33-1/3 r.p.m. record; compilation of sounds of birds, monkeys, insects and amphibians, assembled according to activity in rainy season and dry season. Record is banded for reference to each sound, and a written guide is furnished. $6.95

SOUNDS OF THE SEA: Naval Research Laboratory.

One 12-inch, 33-1/3 r.p.m. record; sounds of shrimp, crabs and various known and unknown fish at different depths and locations. Record is conveniently banded, and a written guide is furnished. $6.95

SOUND PATTERNS: Recorded by many individuals.

One 12-inch, 33-1/3 r.p.m. record; birds, insects, monkey, alligators, tortoise, thunder storm, animal imitations, heartbeats, taxi trip through traffic, jet flight, electronic feedback and other miscellaneous sounds. Record is banded conveniently, some sounds are recorded at slow speeds, and a complete written guide is furnished. $6.95

SOUNDS OF THE AMERICAN SOUTHWEST: Dr. Charles M. Bogert.

One 12-inch, 33-1/3 r.p.m. record; amphibians, reptiles, birds, mammals and a flash flood are recorded, representing sounds of the southwestern part of the U. S. Record is banded conveniently and a written guide is furnished. $6.95

You may culture meal worms, for animal food, in your laboratory. In a large one to five gallon stoneware crock or jar place a quantity of rolled oats or corn meal with the starter culture of your meal worms. Cover the jar, which should only be a fourth to half full of the oats or meal, with a tight fitting screenwire to prevent the escape of the winged adults. Every two or three weeks add a piece of cut apple to the meal to supply moisture, which is not great enough to cause the formation of mold. The culture will keep for several semesters.

New Films and Filmstrips Shown at the Berkeley Meeting

Selection of new film releases for the NABT preview sessions on December 28 and 29 proved a difficult task this year, for the simple reason that more good releases were available than there was time in which to show them. As an added feature this year, filmstrips were included in the preview sessions, and the A-V Committee solicits your reactions to this change.

The list which follows is as complete as time for its inclusion in this issue of the ABT would allow. As a preface to the comments, it should be stated that each of the films and filmstrips selected for previewing is highly recommended for your consideration, and the comments are designed principally to point out certain features of note. To the producers, who were most cooperative in making possible the preview sessions, the A-V Committee owes a debt of gratitude. When you contact them, why not mention the NABT preview sessions?

I. *Films*: (All are 16 mm. sound films)

THE LIFE STORY OF A WATER-MOLD (Allomyces). 12 minutes. Black and white.

The life cycle of a simple fungus plant, illustrating protoplasmic activity and the complexities of alternation of generations. Through the application of phase-contrast photomicroscopy and time-lapse photography, details of all the steps are clearly seen. An excellent teaching film, which should be shown two or three times for greatest effectiveness, this one has a fine teacher's guide complete with glossary. Secondary and early college level. Arthur T. Brice, Phase Films, Ross, California.

MICROSCOPIC WONDERS IN WATER. 11 minutes. Color.

A vivid presentation of minute animal life in pond water, which includes several protozoans, hydra, rotifers and others. With clear detail and good interest, the film also demonstrates microscopic techniques, including one method of slowing down animal activity under the microscope. Widely usable, but best for junior high. Pat Dowling Pictures, 1056 S. Robertson Blvd., Los Angeles 35, Calif.

ELEMENTARY CONSERVATION SERIES (1. YOUR FRIEND THE SOIL; 2. YOUR FRIEND THE WATER; 3. YOUR FRIEND THE FOREST). 7 minutes for each film. Color.

Combining animated and live action, each film emphasizes single important points with respect to uses and care of these natural resources. This restriction to one or two big things to remember is excellent for the intended audience. Story and action are well suited to young pupils, although the value of typewriter opening and closing scenes is open to question. Primary grades. Produced by The Conservation Foundation, and obtainable from Encyclopedia Brittanica Films, 202 East 44th St., New York 17, N. Y.

BIRTH OF A FLORIDA KEY. 14 minutes. Color.

Beautifully photographed account of the development of these interesting bits of land, and of their plant and animal inhabitants. Because of time limitations, the story is somewhat sketchy, but it comprises a well-done lesson in ecology of the Keys. Widely usable, but best in high schools. Films of the Nations, 62 West 45th St., New York 36, N. Y.

INSECT CATCHERS OF THE BOG JUNGLE. 11 minutes. Color.

A superbly balanced presentation of the activities of the pitcher plant, sundew and Venus flytrap. Utilizing time-lapse photography and appropriate humor, this film is a model of fine teaching. Widely useful, but especially good for high schools. William M. Harlow, State College of Forestry, Syracuse University, Syracuse 10, N. Y.

WORLD AT YOUR FEET. 22 minutes. Color.

An excellent survey of soil structure and change, of the plant and animal life in-

habiting the soil, and of the interaction of these organisms with each other and with the soil itself. Interspersed with bits of drama, this is a refreshingly broad view of conservation, with a sound theme throughout. Widely useful, particularly for junior and senior high schools and adult groups. International Film Bureau, Inc., 57 E. Jackson Blvd., Chicago 4, Ill.

CULTIVATE YOUR GARDEN BIRDS. 11 minutes. Color.

How to enjoy and attract birds which frequently visit residential areas. Excellent photography showing about 15 species of birds, plus good suggestions for bringing them to feeders, baths and houses. Interesting and useful to all age groups. International Film Bureau, Inc.

II. *Filmstrips*:

ZOOLOGY SET I and ZOOLOGY SET II. Black and white.

About 30 frames per roll, five rolls in each set. An excellent teaching series for college classes, designed to correlate with Storer's GENERAL ZOOLOGY text. Details are shown clearly, and content is well selected. Set I includes: Protozoans; Sponges and Coelenterates; Flatworms; Roundworms; Echinoderms. Set II includes: Segmented Worms; Mollusks; Crustaceans; Insects; Lower Chordates. McGraw-Hill Book Company, Inc., Text-Film Division, 330 West 42nd St., New York 36, N. Y.

BIRDS—HOW THEY LIVE AND HELP US. Color.

About 40 frames per roll, five rolls in the set. A series especially well suited for high schools, for study of adult and immature birds, eggs, nests and habitats. Helen Cruickshank's fine photography, the development of conservation attitudes and habitat relationships, and the follow-up questions are features of this series, although titles do not always fit pictures. Society for Visual Education, 1345 Diversey Pkwy., Chicago 14, Ill.

EMERY L. WILL, *Chairman*
The Audio-Visual Committee, NABT

Books for Biologists

TREASURY OF PHILOSOPHY. Edited by Dagobert D. Runes. 1280 pp. $15.00. Philosophical Library, New York, New York. 1954.

In this comprehensive collection of philosophical writings are to be found not only the greatest thinkers of the West, but many of the important and less familiar philosophers of the Orient. The selections cover the whole span of recorded philosophy, from the 6th Century B.C. to the present day. Included, of course, are the thinkers of the Greek and Roman periods, as well as the outstanding Hebrew scholars, the Church fathers of the Christian era and the whole prodigious line of modern philosophers from the Renaissance to our days.

Each entry begins with a biographical sketch, covering the significant events in the philosopher's life, listing his major works, and including a concise, careful statement of his place and importance in the history of philosophy. This is followed by one or more representative excerpts from the man's work. Depending on the importance of its author, each excerpt runs from a few paragraphs to several pages in length.

Much of the material contained in the volume appears here in English translation for the first time.

HEALTHIER LIVING. Justus J. Schiffers, Director Health Education Council. 928 pp. $5.75. John Wiley and Sons, Inc. New York 16, New York. 1954.

This text in personal and community health is written, in part, as the delayed personal reaction of the author against the "limited, formalized, rigid and partly ridiculous instruction that I received in the name of hygiene as a college freshman over a quarter century ago." It is a book on health—not disease. Written over a period of six years, it was compounded to the prescription of 300 college physicians, educators, administrators and others. It is one health book that doesn't often say "Don't." After the introduction, it is divided into family living (30 per cent), mental health (20 per cent), personal health (25 per cent), and community health (20 per cent). The book is written for a college course but would be very useful as reference at the high school level.

HISTOLOGY. Edited by Roy O. Greep, Dean and Professor of Dental Science, Harvard School of Dental Medicine. 953 pp. $15.00. The Blakiston Company, Inc. New York, New York. 1954.

A text designed for teaching the newer methods and techniques of histology, which evidences

New Jersey Science Teacher's Association

Teachers of the New Jersey Science Teacher's Association are invited to visit the science classrooms in the Somerville High School, Somerville, New Jersey, March 19, 1955. Boys and girls will present *Community Science In The School*. Topics to be discussed include:

Biology
1. Know Your Blood Type and Rh Factor
2. Better Rabbits Through Genetics
3. Hydroponics
4. Grafting and Budding
5. Accelerated Chick Growth
6. Isotopes in Living Organisms

Chemistry
1. Oxygenation and Carbonation of Blood
2. Plastics
3. Dyes
4. Ion Exchange

General Science
Dairy Processes
1. Babcock Test
2. Pasteurization
3. Bacteria Count

Physics
1. Atomic Radiation
2. Sound Communication

A luncheon will follow with a guest speaker from the Bell Telephone Company.

BOOKS (Continued)

the newer methods and techniques on the study of both living and fixed tissues.

BASIC BOTANY. Second edition. Fred W. Emerson, formerly Professor of Botany, New Mexico Highlands University. 425 pp. $5.00. The Blakiston Company, Inc. New York, New York, 1954.

The second edition of this botany textbook has kept the desirable features of the first edition, incorporated corrections, added certain material, and in general has been brought up-to-date.

THE HIDDEN LIFE OF FLOWERS. Photographs by R. H. Noailles, translated from the French text of J. M. Guilcher. 93 pp. $4.75. Philosophical Library, New York 16, New York. 1954.

This attractive book is essentially a collection of photographs depicting various phases of the reproductive process of a number of plants. The

BOOKS (Continued)

photographs, in photogravure, are mostly enlargements. They are excellent examples of how the camera can record details of plant structure and behaviour.

BIRDS THE WORLD OVER. Austin L. Rand and Emmet R. Blake, Curator and Associate Curator, respectively, Chicago Natural History Museum. 96 pp. $1.50. Chicago Natural History Museum, Chicago, Illinois. 1954.

A well illustrated book of the bird habitat groups found in exhibits at the Chicago Natural History Museum. Many interesting facts are presented about various groups of birds: North American Birds; Birds of the Hawaiian Islands; Birds of Europe and Asia; and Antarctic Birds.

MUSIC THERAPY. Edited by Edward Podolsky, M.D. 335 pp. $6.00. Philosophical Library, New York, New York. 1954.

The practical applications of music therapy in a variety of mental, emotional and physical ailments have been established in many clinics and hospitals throughout the world. This book is a compilation of thirty-five papers, on this subject, which were originally published in a number of journals.